MOTOROLA INC.

February 11, 1993

Ms. Donna Searcy
Secretary
Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, DC 20554

Re: Gen. Docket 90-314
ET Docket 92-9

Dear Ms. Searcy:

Enclosed is a copy of information used in discussions on PCS/Emerging Technologies with Dr. Thomas Stanley and his staff yesterday afternoon.

Regards,

Stu Overby
Manager, Regulatory Programs

FCC Discussion

Agenda

1. 900 MHz Narrowband PCS

2.. Unlicensed PCS

3. Licensed 1.8 GHz PCS

Motorola Narrowband PCS Perspectives:

Need a bandplan that conserves spectrum and provides flexibility.

Advanced messaging service is one ideal use of this 3 MHz.

AMS is asymmetrical and two way in nature.

The next generation of symmetrical data services is a second ideal use of this 3 MHz.

Create "quiet" talk in channels to allow for low cost infrastructure and small end user devices.

One way services can be accommodated using existing spectrum (higher speed codes) for next few years.

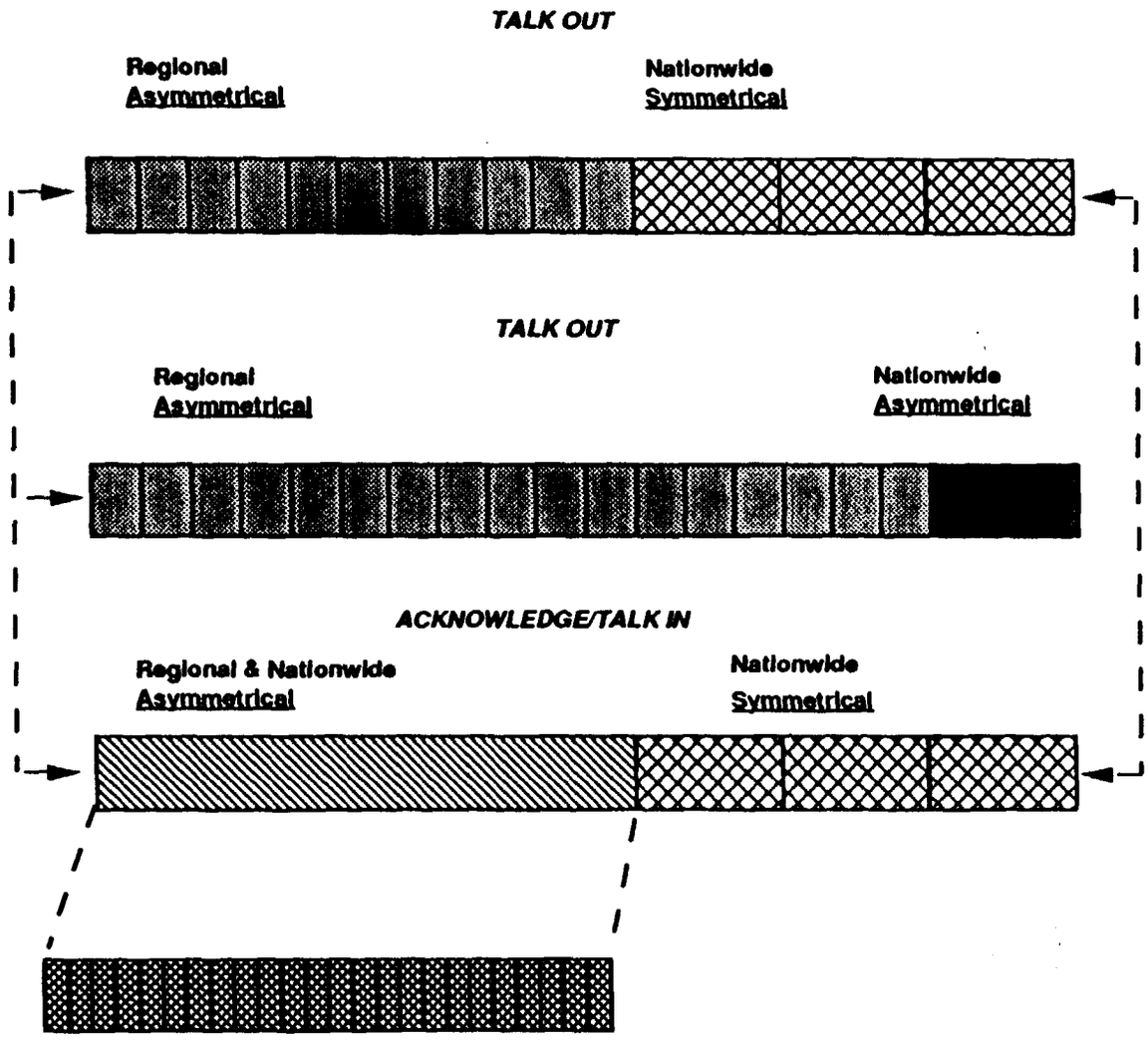
PCS-Narrowband (900 MHz)

Reply comments:

<u>Most agreement on:</u>
Asymmetric pairs.
Band should be used for AMS.
5 regions and no local licenses.
901-902 MHz to be used as "quiet" talk in band.
Open entry.
Lotteries with higher entry fees, etc.
Split narrowband off and release rules first.

<u>Less agreement on:</u>
Band plan and channel width per licensee.

MOTOROLA PROPOSED NARROWBAND PCS BAND PLAN



940-941 MHz.

3, 150 kHz channels paired with 901

11, 50 kHz channels paired with 901 (12.5 kHz pieces)

930-931 MHz.

20, 50 kHz. channels paired with 901 (12.5 kHz pieces)

901-902 MHz.

44, 12.5 kHz. channels
31 automatic pairing with talk out,
13 available for existing systems.

3, 150 kHz channels paired with 940 channels

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FIGURE1

Unlicensed PCS

- ***What has to occur for this service to be successful?***

Clear spectrum for nomadic devices. No deployment prior to clear spectrum.

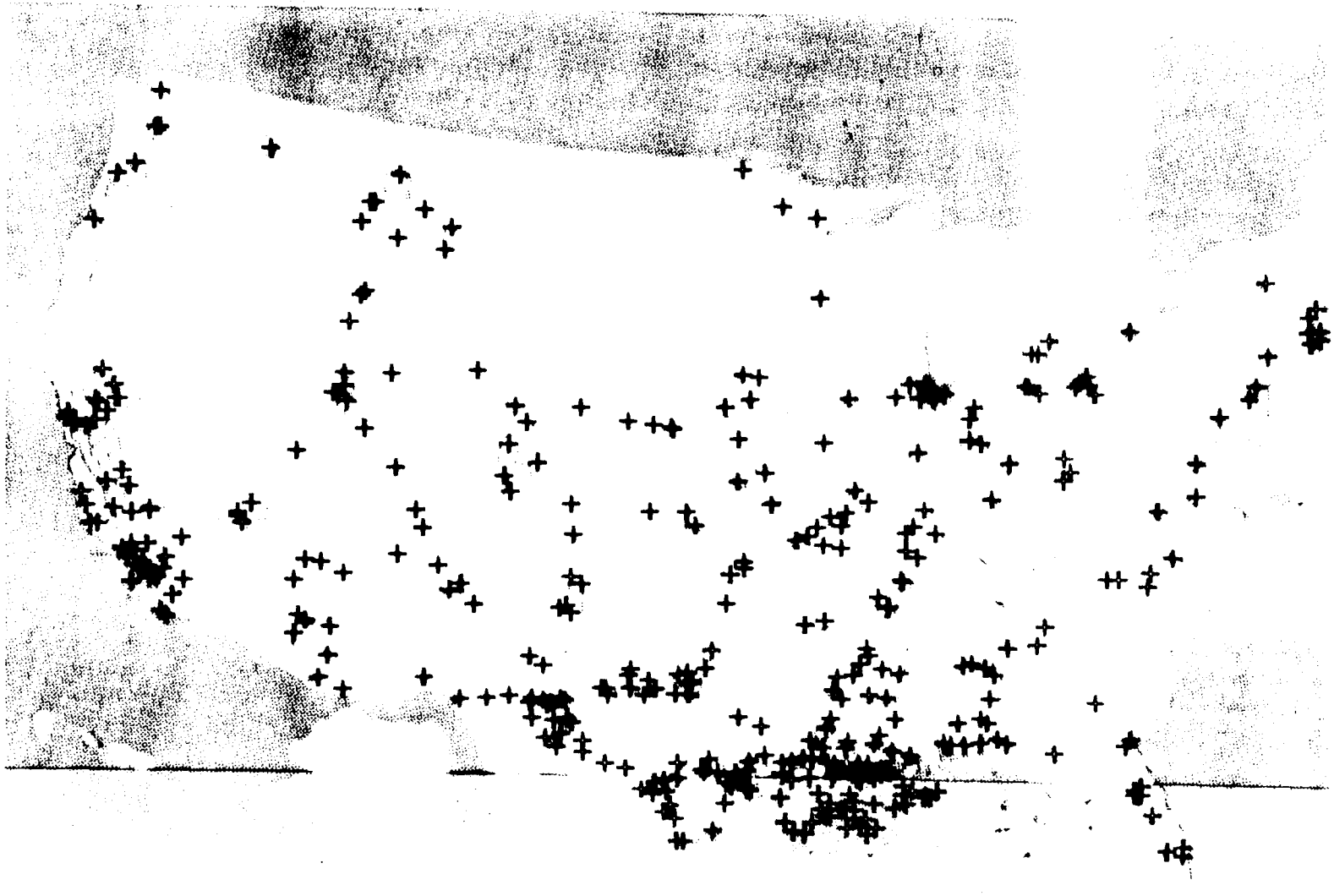
Early deployment of non nomadic devices using coordination to protect incumbents.

A fair method of funding the M/W moves.

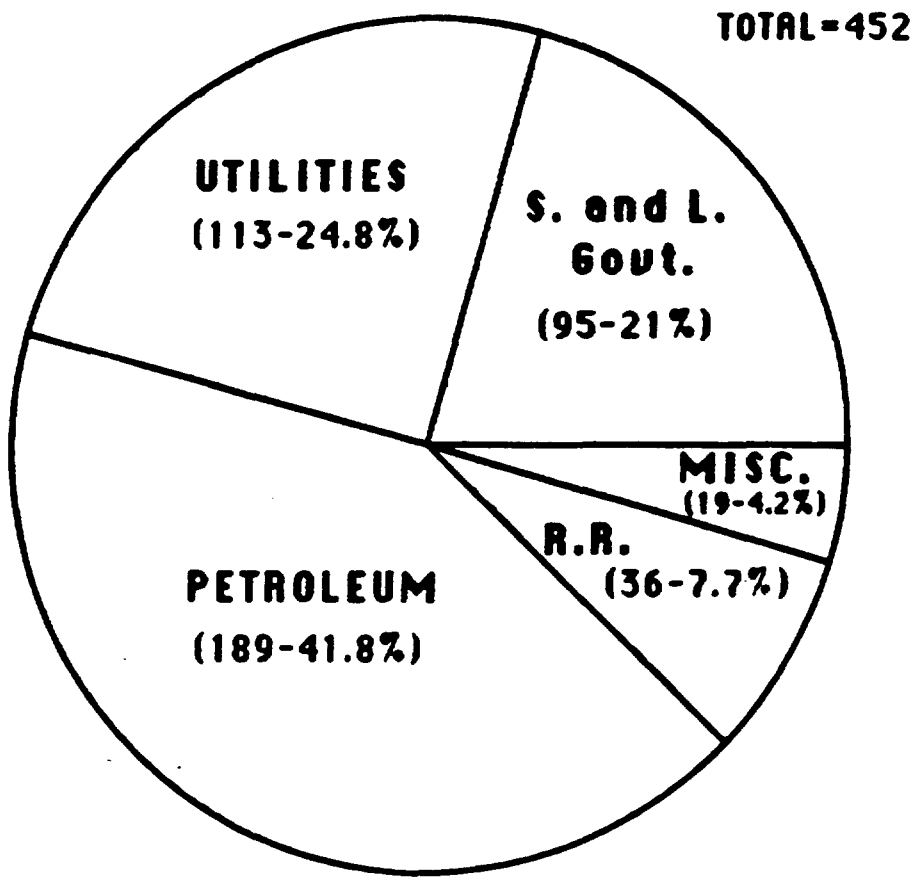
All potential players must be required to share in the costs of clearing the spectrum.

Rules requiring all devices to conform to an etiquette.

U.S. M.S.A.'s 1910-1930 Receivers



MICROWAVE LINKS BY TYPE (1910-1930MHZ) (U.S.)



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Summary of Microwave Visits:

Visited:
Commonwealth Edison (70 link system)
American Petroleum Institute
Utilities Telecommunication Council

Items of interest:

Incumbents are willing to move, but the move itself is complex.

New links must operate in parallel with old for a period of time.

Tower wind loading will be exceeded in many cases with one more dish.

Lack of any space on some towers.

Incumbent has to hire people and plan for each link that is moved.

Some towers need bases reinforced if extensions added.

Some towers may need remeasurement from scratch (for wind loading.

Towers will not be climbed in Winter or Summer peak power months.

Incumbents may not need incentives to move early. Most worried about 6 GHz crowding.

Incumbents are against two moves (repacking).

Estimates of all incumbents to move is 3 1/2 to 12 years.

One link can be moved in 18 months or sooner.

Incumbents need to buy into the notion of "non nomadic" with regard to interference.

The FCC must complete the work for channelization at 6 GHz.

API feels 6 GHz over water is an issue (Gulf problem)

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Unlicensed PCS

- *Clear spectrum for nomadic devices:*

Status:

Due to the nature of these portable devices, the location cannot be controlled.

Deployment before clearing would result in interference to the incumbents that could not be located.

The FCC rules must state that all players must join the consortium and follow it's rules.

Unlicensed PCS

- ***Coordination and protection of incumbents during clearing while non nomadic devices are deployed:***

Status:

Non nomadic devices can be deployed prior to full clearing of the band on a coordinated basis. (Use 10E)

Non nomadic devices must be deployed in order to start payback of initial funding to move incumbents.

Definition of non nomadic must be agreed to by incumbents.

Deployment prioritized by population will be used.

Either the FCC or some industry Entity must perform the coordination.

Unlicensed PCS

- ***A fair method of funding the M/W moves:***

Status:

Consortium must be created that will raise the money.

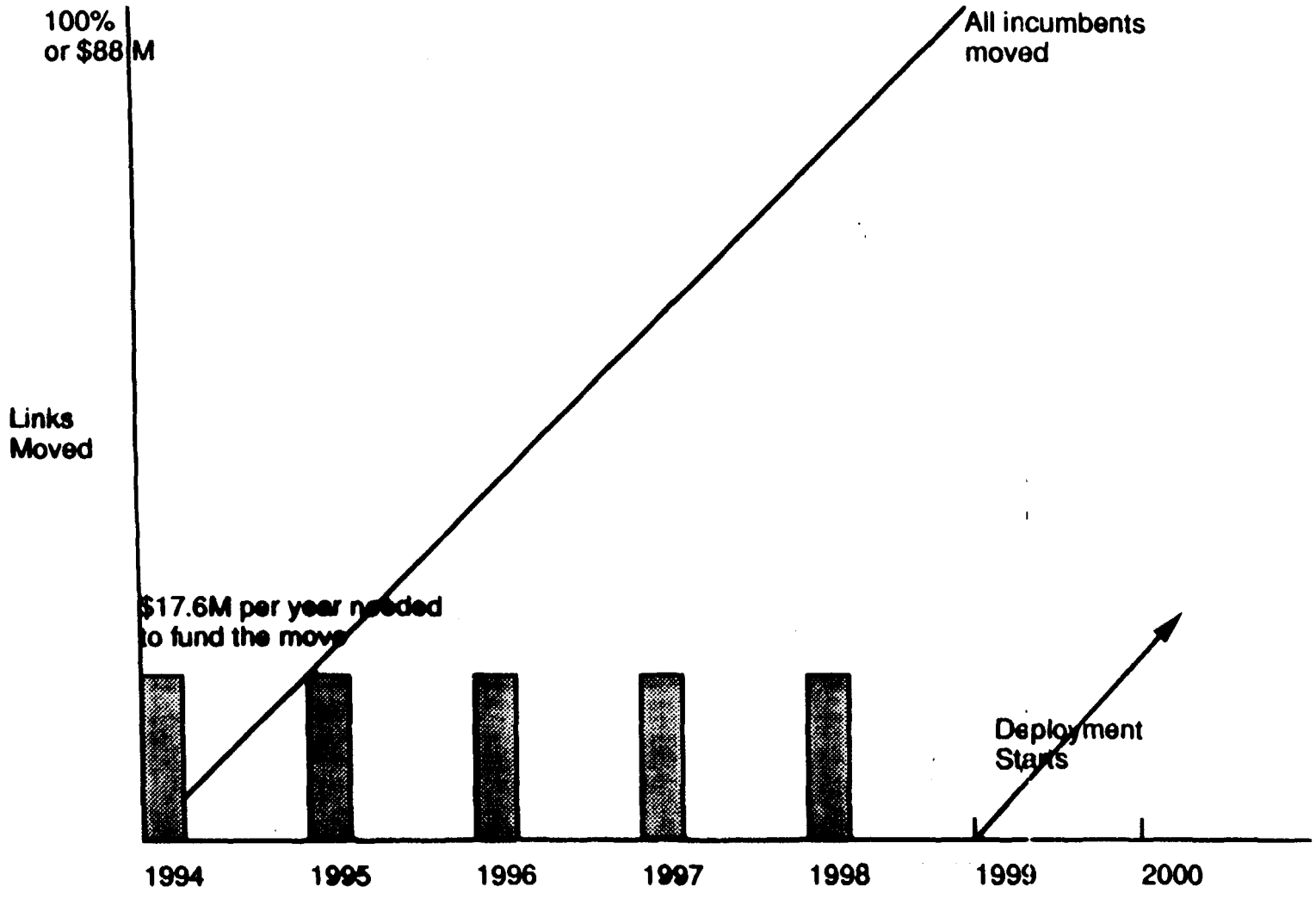
Ad Hoc committee (WINForum, Telocator, others) working on structure, financing, legal issues.

Payback of funds to move incumbents must come from deployment of non nomadic devices first, nomadic later.

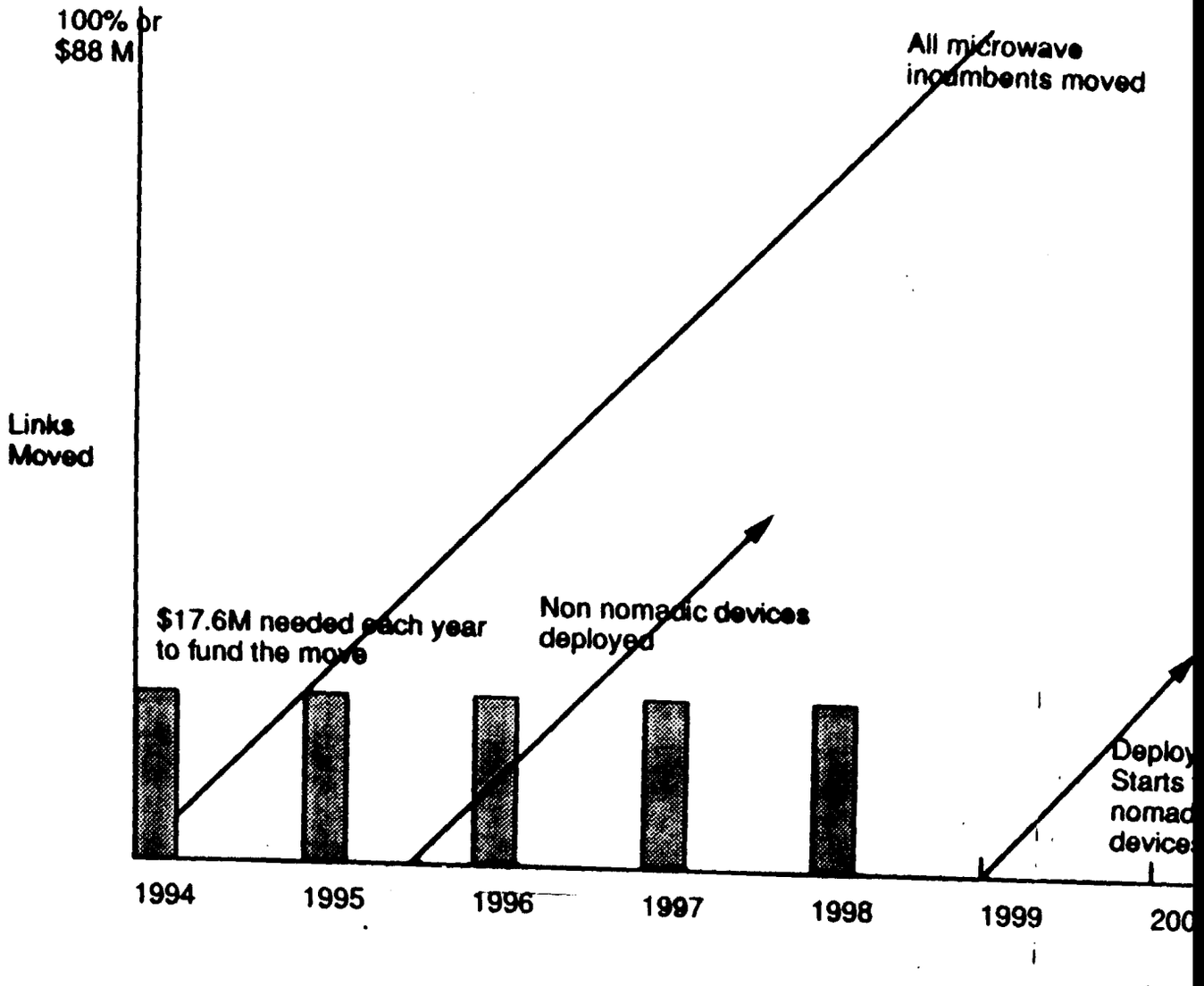
Funding alternatives under investigation:

SEC registered securities
Preferred Stock
Royalty Contract with right to assign
Royalty Contract with right to sell
Long and short term bank loans
Bonds, secured and unsecured

CASE A- No deployment until band is cleared



CASE B- Deployment of non nomadic



Interest on 17.6M is 1.76M ..1995 interest due is 1.76M Sales must be approx . 35M

Total cost= $11,800k

Metropolitan Statistical Areas/Links to be cleared.

*Cost per user if 5% penetration

MSA or CMSA	Population	Microwave Links (Approx)	Cost to deploy/ pop
New York, Northern New Jersey, Long Island, NY, NY-NJ-CT CMSA	18,087,251	3	$0.03 (0.67)*
Los Angeles-Anaheim-Riverside, CA CMSA	14,531,529	10	$0.14 (2.75)*
Chicago-Gary-Lake County, Il-In-Wi CMSA	8,065,633	6	$0.15 (2.97)*
Washington-Baltimore, DC-MD-VA CMSA	6,305,746	2	$0.06 (1.27)*
San Francisco-Oakland-San Jose, CA CMSA	6,253,311	5	$0.16 (3.19)*
Philadelphia-Wilmington-Trenton, PA-NJ-DE-MD CMSA	5,899,345	1 (others counted above)	$0.03 (0.68)*
Detroit-Ann Arbor, Mi CMSA	4,665,236	3	$0.13 (2.57)*
Boston-Lawrence-Salem, MA-NH CMSA	4,171,643	7	$0.33 (6.71)*
Dallas-Fort Worth, TX CMSA	3,885,415	7	$0.36 (7.20)*
Houston-Galveston-Brazoria, TX CMSA	3,711,043	13-18 (without offshore)	$0.70 (14.00)*
Miami-Fort Lauderdale, Fl CMSA	3,192,582	0 (3 with WPB)	$0.19 (3.76)*
Atlanta, Ga	2,833,511	2	$0.14 (2.82)*

81,602,245 32% of population	59 13% of total links

Unlicensed PCS

- ***All potential players must be required to share in the costs to clear the spectrum:***

Status:

There is agreement that the band is open to all manufacturers.

The Ad Hoc committee is developing a mechanism that is fair to both small and large companies and also fair to early players and late comers.

Unlicensed PCS

- ***An etiquette for PCS -to- PCS device spectrum sharing:***

Status:

WINForum has an etiquette ready for release based on "listen before talk".

Etiquette allows migration of data to voice and voice to data spectrum.

The FCC must enforce the use of this etiquette. This could be through product certification.

Unlicensed PCS

Most agreement on:

20 MHz should be allocated for unlicensed.

Band must be cleared for deployment of unlicensed devices.

An entity must be created to aid in the M/W incumbent move.

Conformance to the Etiquette and a mechanism to clear the band must be part of the rules.

Paging & Wireless Data Group

Unlicensed PCS

These parties support establishment of some compensation mechanism or entity for the relocation of 2 GHz microwave licensees from the 1910-1930 MHz band:

American Petroleum Institute
Association of American Railroads
AT&T
California Microwave, Inc.
Central and South West
Commonwealth Edison Company
Edison Electric Institute
Hewlett Packard
Hitachi Telecom (USA)
Lower Colorado River Authority
Metropolitan Water District of Southern California
Montana Power Co.
Motorola

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National Rural Electric Cooperative
Niagara Mohawk Power Corporation
North American Telecommunications Association
Northern Telecom
Pennsylvania Public Utilities
Questar Service Corp
Rolm
Tandy Corp
Telocator
Utilities Telecommunications Council
WINForum
Xircom Corp

Average Spectrum Availability for PCS[4]

No microwave links relocated

	2 Lic/40 MHz	3 Lic/30 MHz	5 Lic/20 MHz
	MHz	MHz	MHz
New York	24.8	18.5	12.2
Los Angeles	18.2	13.5	9.0
Chicago	19.3	14.7	9.8
Washington, D.C.	34.7	26.2	17.5
Philadelphia	28.9	21.2	14.1
Detroit	29.3	22.5	15.2
Boston	33.9	25.4	16.9
Dallas	24.3	18.3	12.2
Houston	21.2	16.2	11.1
Miami	25.3	19.3	12.8
San Francisco	22.7	17.1	11.3
Average	25.7	19.4	12.9

This analysis shows each licensee is seriously disadvantaged at startup if the Commission ultimately decides to award only 20 MHz per licensee as some commenters and an Office of Plans and Policy ("OPP") report have suggested.[5] Motorola's concern with OPP's analysis focuses on the incumbent users of the proposed spectrum and their effect on the amount of spectrum each licensee needs to initiate PCS Service. The OPP paper provides a credible, though narrowly

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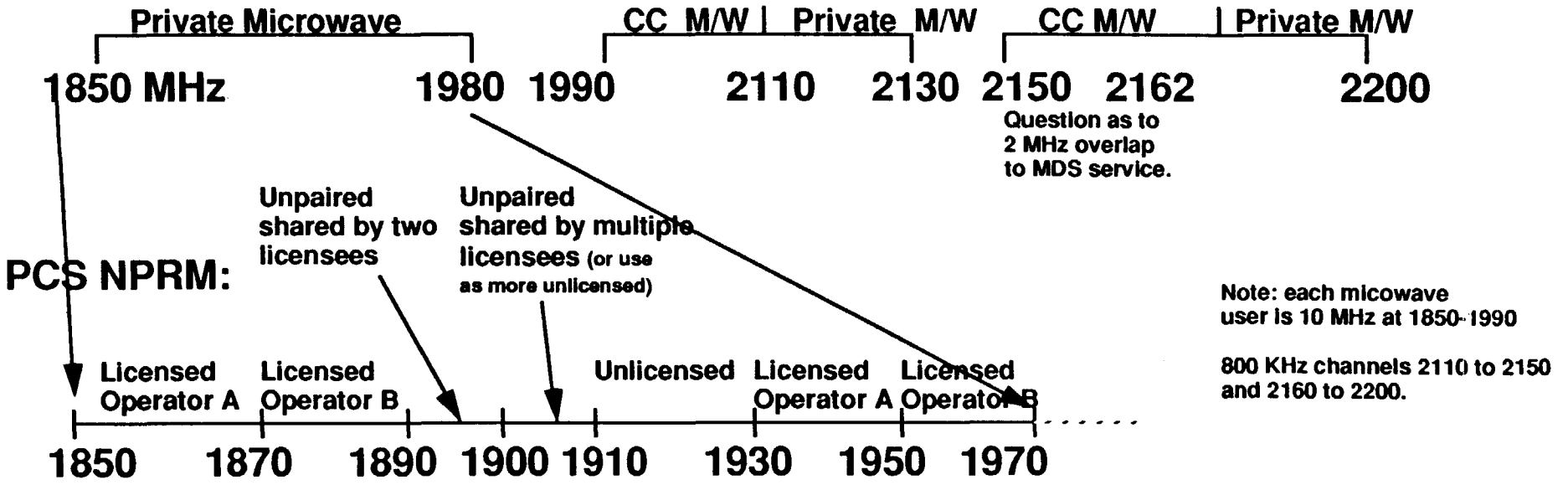
[4] "Report on Spectrum Availability for Personal Communication's Services Sharing the 1850-1990 MHz Band with the Private Operational Fixed Microwave Service" by American Personal Communications, November 1992, at 27.

[5] "Putting It All Together: The Cost Structure of Personal Communications Services" by David P. Reed, Office of Plans and Policy Working Paper No. 82, November 1992, at V and 53-55

Motorola Postion Submitted to the FCC

Emerging Technologies Spectrum "Broadband PCS Service"

Spectrum released under the Emerging Technologies Docket:



WARC Region 2 MSS	1970-2010 (uplink)	2160-2200 (downlink)
WARC WW MSS	1980-2010 (uplink)	2170-2200 (downlink)

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PCS-MICROWAVE SPECTRUM SHARING
ALLOCATION
VS.
REUSE

IMPACT

FREQUENCY REUSE PATTERN REQUIREMENTS MUST BE CONSIDERED WHEN ESTABLISHING MINIMUM SPECTRUM ALLOCATIONS (TO A LICENSEE).

EXAMPLE:

AN 800KHZ/CHANNEL (2*400KHZ, FDD) WITH A 21X REUSE PATTERN REQUIRES 21*800=16.8MHZ (TWO 8.4MHZ PAIRS) TO PROVIDE ONE CHANNEL (MAX[1]) CAPABILITY PER CELL, EVERYWHERE (I.E. UBIQUITOUS COVERAGE).

IF THE CHANNEL CAN SUPPORT 10 VOICE CHANNELS (E.G. 10 SLOT TDMA) THEN 10 (MAX) SIMULTANEOUS CALLS PER CELL OR 10 ERLANGS/CELL CAN BE PROVIDED, EVERYWHERE.

CONSIDERING MOTOROLA'S PPS-1800[2] PCS OFFERING, TABLE 1 IS CONSTRUCTED TO SHOW ERLANG/CELL CAPACITY AS A FUNCTION OF AVAILABLE SPECTRUM AND ASSUMED REUSE PATTERN:

TABLE 1 [3]

	TOTAL SYSTEM B.W. (Mhz)				
REUSE PATTERN SIZE	20	30	40	50	60
16	7.97	13.55	19.72	26.17	32.72
21	5.2	9.46	14.05	18.29	23.56
25	3.78	7.36	11.23	14.79	18.64

NOW CONSIDER PCS 2GHZ SHARED SPECTRUM ALLOCATIONS OF 30 AND 40MHZ PER LICENSEE:

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[1] THIS MAXIMUM IS REDUCED WHEN CONSIDERING SUFFICIENTLY HIGH E.G. 1% GRADE-OF-SERVICE. ALSO, ANY CAPACITY USED FOR SIGNALLING/CONTROL FURTHER REDUCES THE MAXIMUM VOICE CHANNEL CAPACITY.

[2] SIMILAR ALSO TO BELLCORE.

[3] REF. "THE MOTOROLA PPS-1800 LOW-TIER WIRELESS PERSONAL COMMUNICATIONS SYSTEM"

40MHZ

40MHZ IMPLIES 2 SEPARATED SEGMENTS OF 20MHZ EACH, WITH EACH SEGMENT TOTALLY COINCIDENT WITH TWO 10MHZ MICROWAVE CHANNELS. ASSUMING PCS OPERATION WITHIN ONE OF THE MICROWAVE CHANNELS IS NOT ALLOWED DUE TO INTERFERENCE POTENTIALS, THE LICENSEE IS LEFT WITH TWO 10MHZ SEGMENTS OR 20MHZ TOTAL. (Table 2)

Table 2.

CH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ALL	******	******							******	******				
ACT	******	X							******	X				

FROM TABLE 1 IT IS SEEN THAT UBIQUITOUS COVERAGE IS POSSIBLE FOR ANY OF THE THREE REUSE PATTERNS, SUPPLYING FOR EXAMPLE 5.2 ERLANGS/CELL CAPACITY EVERYWHERE, WITH A 21X REUSE.
{EVEN IF TOTAL SPECTRUM IS REDUCED TO 15MHZ BY THE EXISTANCE OF A MICROWAVE INTERSTITIAL CHANNEL BETWEEN CH 1&2/9&10, 15MHZ/800KHZ = 18.75, WHICH WOULD ALLOW A 16X REUSE}

30MHZ

30MHZ IMPLIES 2 SEPARATED SEGMENTS OF 15MHZ EACH, WITH EACH SEGMENT COMPRISED OF ONE FULL 10MHZ MICROWAVE CHANNEL AND A HALF OF ANOTHER. ASSUMING PCS OPERATION WITHIN ONE OF THE MICROWAVE CHANNELS IS NOT ALLOWED DUE TO INTERFERENCE POTENTIALS, THE LICENSEE IS LEFT WITH THE POTENTIAL OF TWO 5MHZ SEGMENTS OR 10MHZ TOTAL. (Table 3)

Table 3.

CH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ALL	***	******							***	******				
ACT	***	X							***	X				

THERE IS INSUFFICIENT SPECTRUM TO PROVIDE UBIQUITOUS COVERAGE. WITH ONLY TWELVE 400KHZ CHANNELS (10MHZ/800KHZ =12.5), EVEN A 16 CELL REUSE CANNOT BE OBTAINED, RESULTING IN "ISLANDS OF COVERAGE" WITH SUFFICIENT SEPARATION TO ENSURE TOLERABLE LEVELS OF CO-CHANNEL INTERFERENCE.
{EXISTENCE OF MICROWAVE INTERSTITIALS WOULD REDUCE AVAILABLE SPECTRUM TO ABOUT 5MHZ....TOTALLY UNACCEPTABLE}